

2N7002

60 V, 300 mA N-channel Trench MOSFET

Rev. 7 — 8 September 2011

Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using Trench MOSFET technology.

1.2 Features and benefits

- Suitable for logic level gate drive sources
- Surface-mounted package
- Very fast switching
- Trench MOSFET technology

1.3 Applications

- Logic level translators
- High-speed line drivers

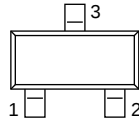
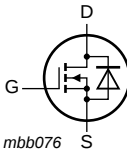
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	-	60	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{sp} = 25\text{ °C}$; see Figure 1 ; see Figure 3	-	-	300	mA
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$; see Figure 2	-	-	0.83	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 500\text{ mA}$; $T_j = 25\text{ °C}$; see Figure 6 ; see Figure 8	-	2.8	5	Ω

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	S	source		
3	D	drain		
			SOT23 (TO-236AB)	mbb076

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
2N7002	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

4. Marking

Table 4. Marking codes

Type number	Marking code ^[1]
2N7002	12%

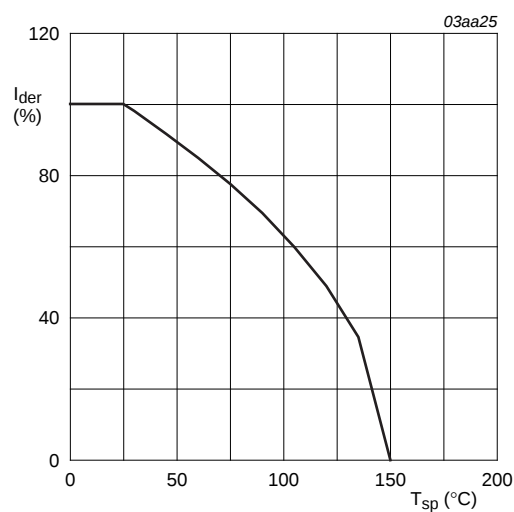
[1] % = placeholder for manufacturing site code

5. Limiting values

Table 5. Limiting values

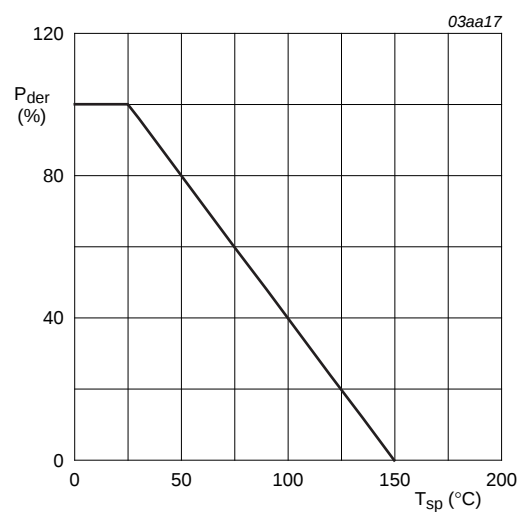
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	60	V
V_{GS}	gate-source voltage		-30	30	V
V_{GSM}	peak gate-source voltage	pulsed; $t_p \leq 50\text{ }\mu\text{s}$; $\delta = 0.25$	-40	40	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{sp} = 25\text{ °C}$; see Figure 1 ; see Figure 3	-	300	mA
		$V_{GS} = 10\text{ V}$; $T_{sp} = 100\text{ °C}$; see Figure 1	-	190	mA
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{sp} = 25\text{ °C}$; see Figure 3	-	1.2	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$; see Figure 2	-	0.83	W
T_j	junction temperature		-65	150	°C
T_{stg}	storage temperature		-65	150	°C
Source-drain diode					
I_S	source current	$T_{sp} = 25\text{ °C}$	-	300	mA
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{sp} = 25\text{ °C}$	-	1.2	A



$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 1. Normalized continuous drain current as a function of solder point temperature



$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100\%$$

Fig 2. Normalized total power dissipation as a function of solder point temperature

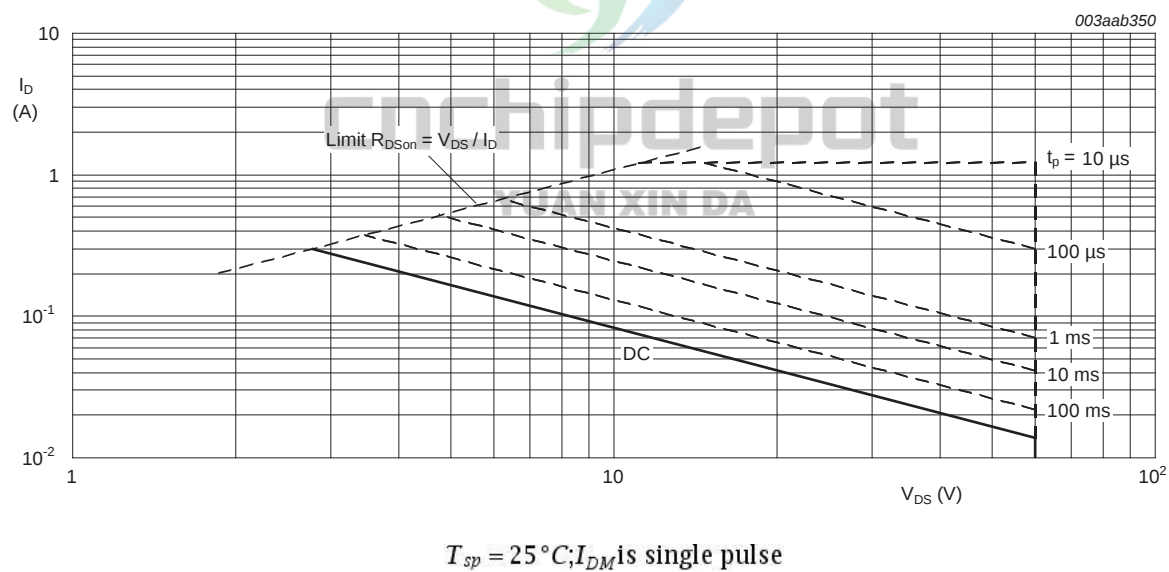
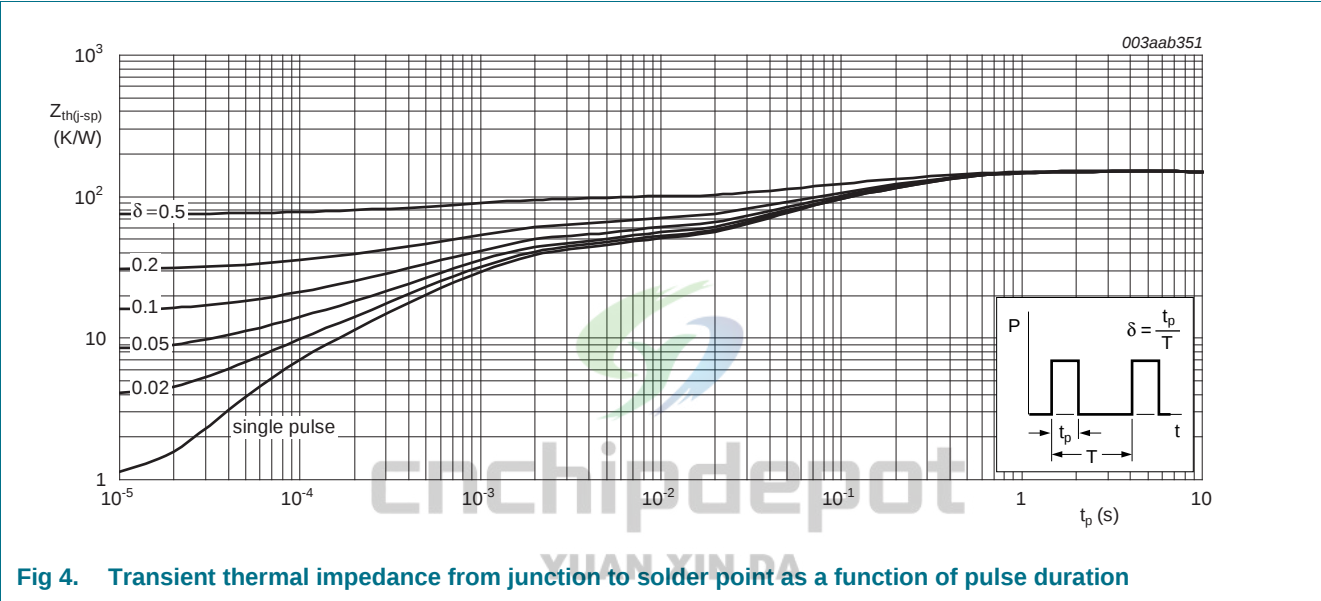


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	Mounted on a printed-circuit board; minimum footprint ; vertical in still air	-	-	350	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point	see Figure 4	-	-	150	K/W



7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 10 μA; V _{GS} = 0 V; T _j = 25 °C	60	-	-	V
		I _D = 10 μA; V _{GS} = 0 V; T _j = -55 °C	55	-	-	V
V _{GStH}	gate-source threshold voltage	I _D = 0.25 mA; V _{DS} = V _{GS} ; T _j = 25 °C; see Figure 9 ; see Figure 10	1	2	2.5	V
		I _D = 0.25 mA; V _{DS} = V _{GS} ; T _j = 150 °C; see Figure 9 ; see Figure 10	0.6	-	-	V
		I _D = 0.25 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 9 ; see Figure 10	-	-	2.75	V
I _{DSS}	drain leakage current	V _{DS} = 48 V; V _{GS} = 0 V; T _j = 25 °C	-	0.01	1	μA
		V _{DS} = 48 V; V _{GS} = 0 V; T _j = 150 °C	-	-	10	μA
I _{GSS}	gate leakage current	V _{GS} = 15 V; V _{DS} = 0 V; T _j = 25 °C	-	10	100	nA
		V _{GS} = -15 V; V _{DS} = 0 V; T _j = 25 °C	-	10	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 500 mA; T _j = 25 °C; see Figure 6 ; see Figure 8	-	2.8	5	Ω
		V _{GS} = 10 V; I _D = 500 mA; T _j = 150 °C; see Figure 6 ; see Figure 8	-	-	9.25	Ω
		V _{GS} = 4.5 V; I _D = 75 mA; T _j = 25 °C; see Figure 6 ; see Figure 8	-	3.8	5.3	Ω
Dynamic characteristics						
C _{iSS}	input capacitance	V _{DS} = 10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C	-	31	50	pF
C _{oSS}	output capacitance		-	6.8	30	pF
C _{rSS}	reverse transfer capacitance		-	3.5	10	pF
t _{on}	turn-on time	V _{GS} = 10 V; V _{DS} = 50 V; R _L = 250 Ω;	-	2.5	10	ns
t _{off}	turn-off time	R _{G(ext)} = 50 Ω; R _{GS} = 50 Ω	-	11	15	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 300 mA; V _{GS} = 0 V; T _j = 25 °C; see Figure 11	-	0.85	1.5	V
Q _r	recovered charge	V _{GS} = 0 V; I _S = 300 mA;	-	30	-	nC
t _{rr}	reverse recovery time	dI _S /dt = -100 A/μs	-	30	-	ns

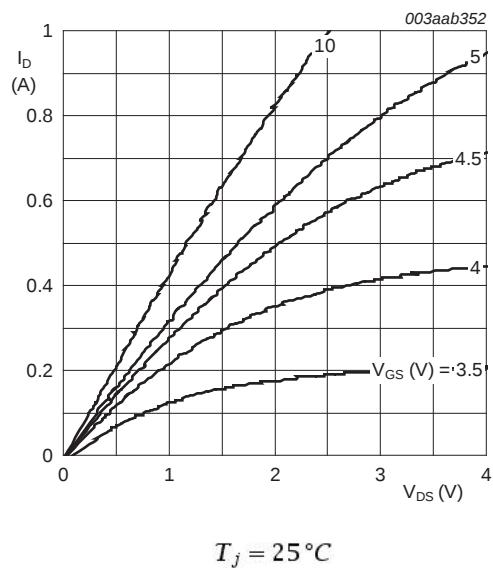


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

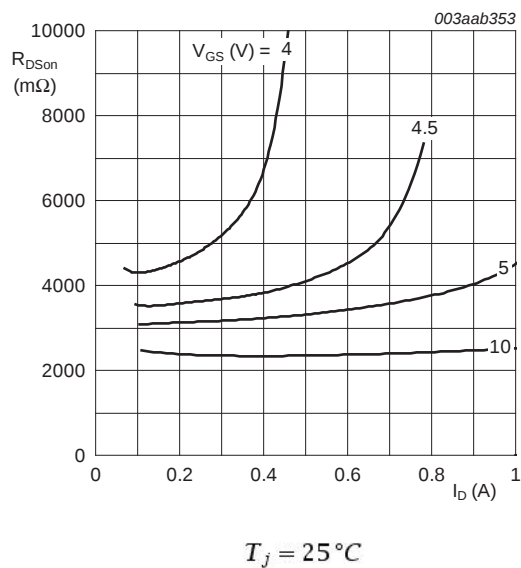


Fig 6. Drain-source on-state resistance as a function of drain current; typical values

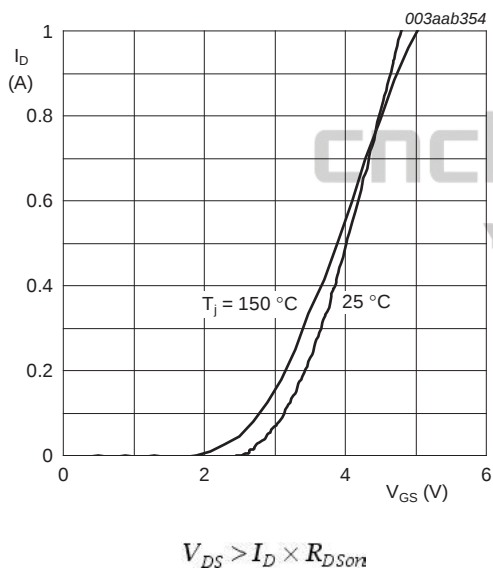


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

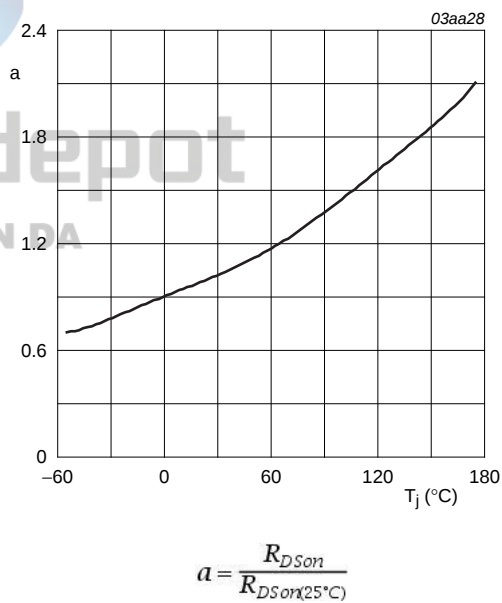


Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature

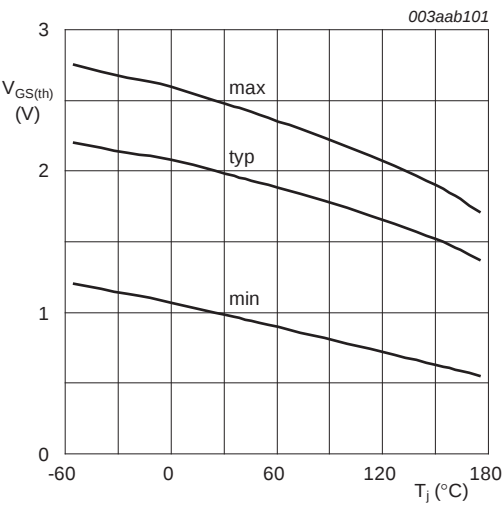


Fig 9. Gate-source threshold voltage as a function of junction temperature

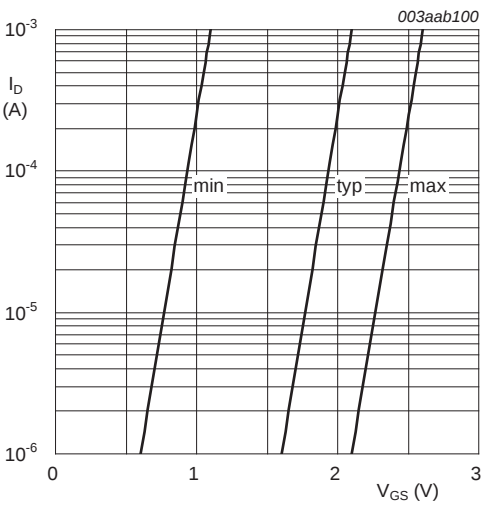


Fig 10. Sub-threshold drain current as a function of gate-source voltage

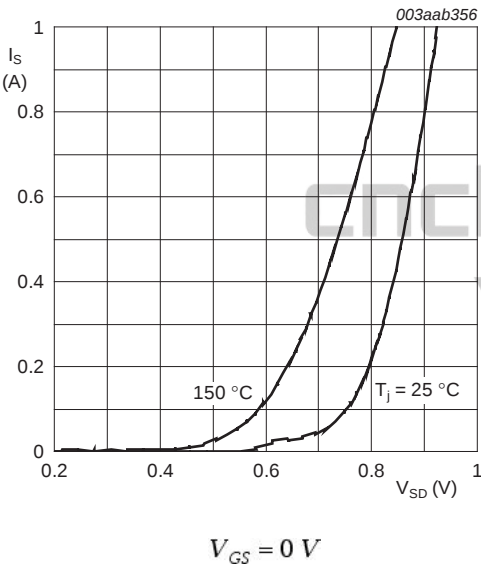


Fig 11. Source current as a function of source-drain voltage; typical values

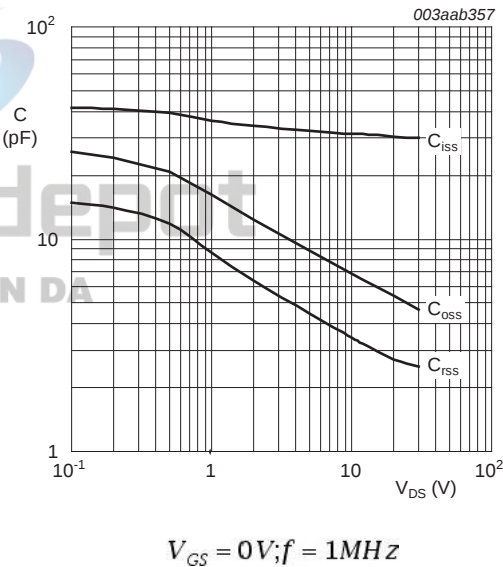


Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

8. Package outline

Plastic surface-mounted package; 3 leads

SOT23

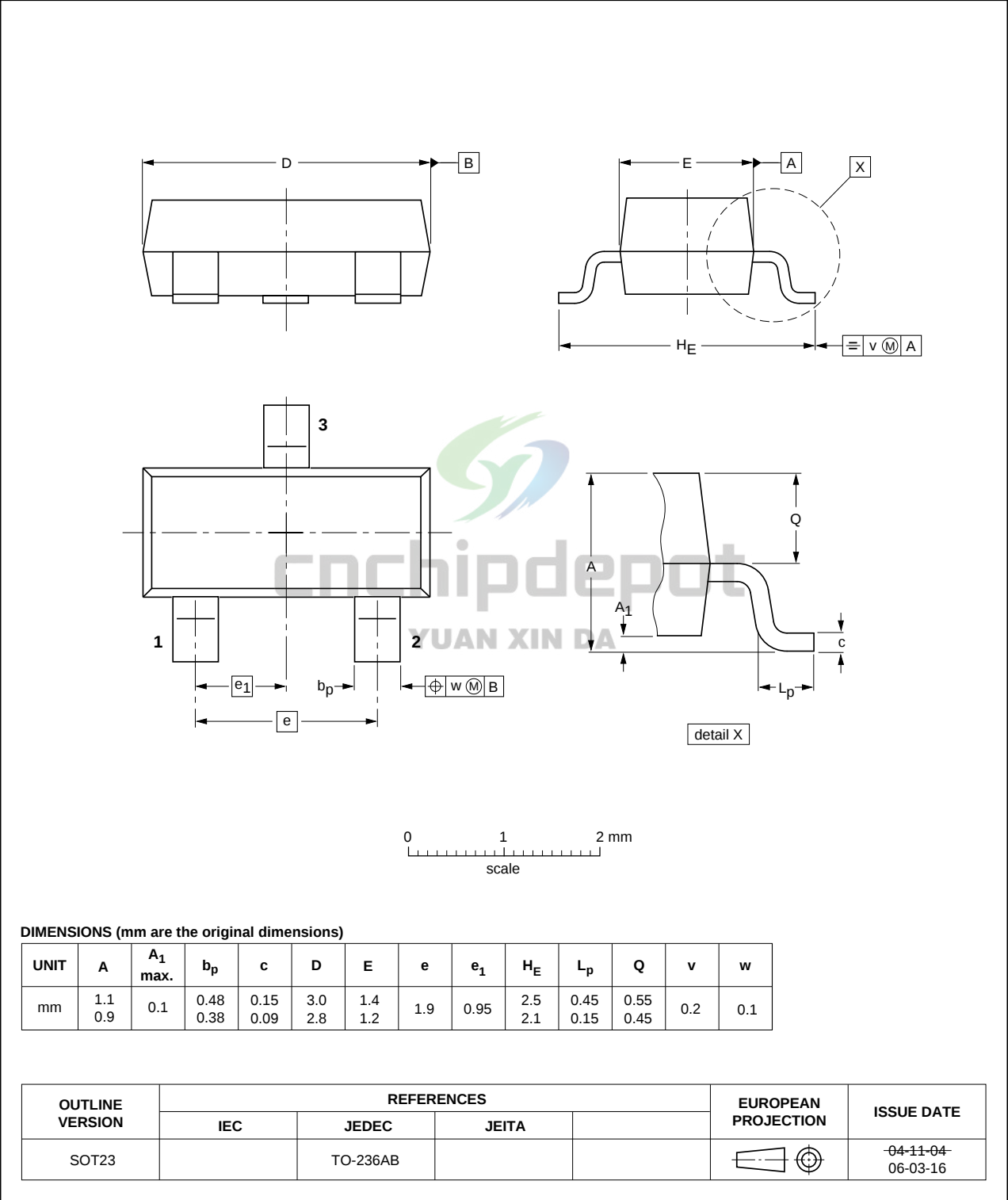
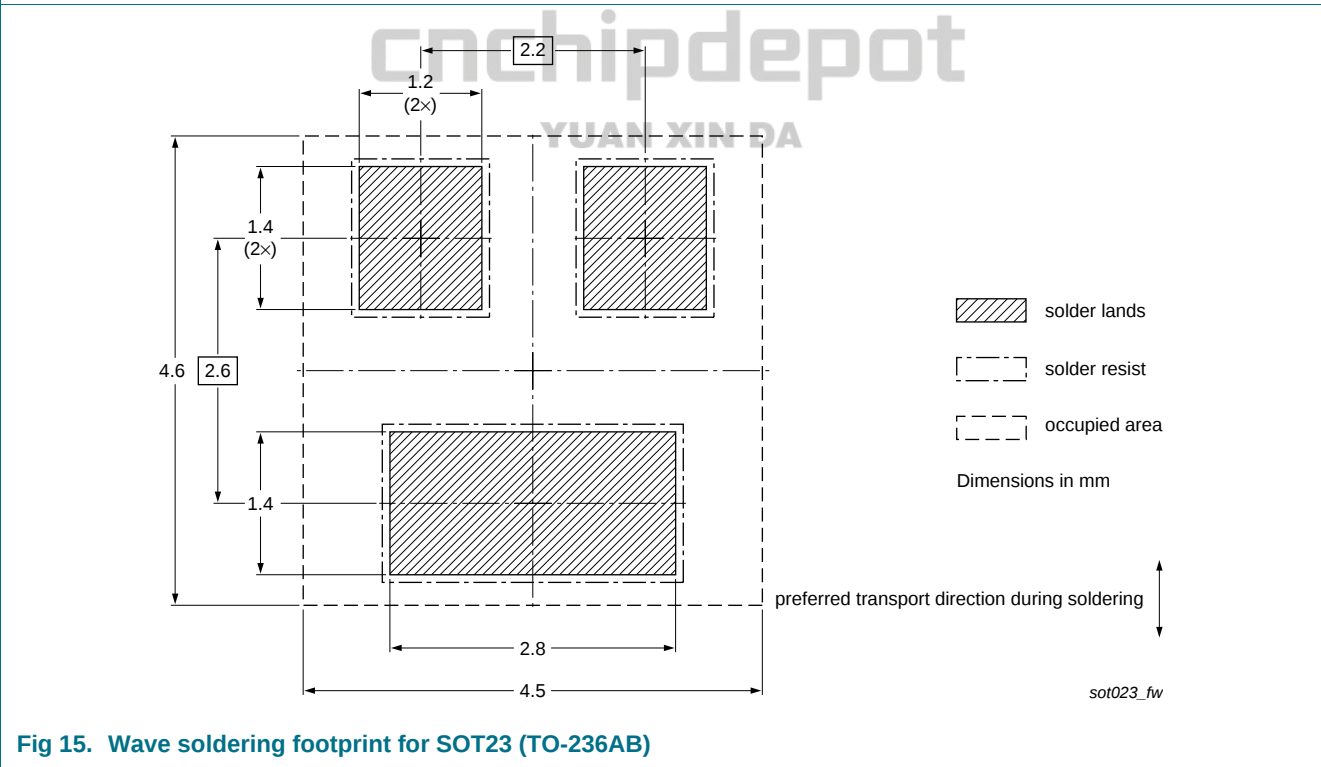
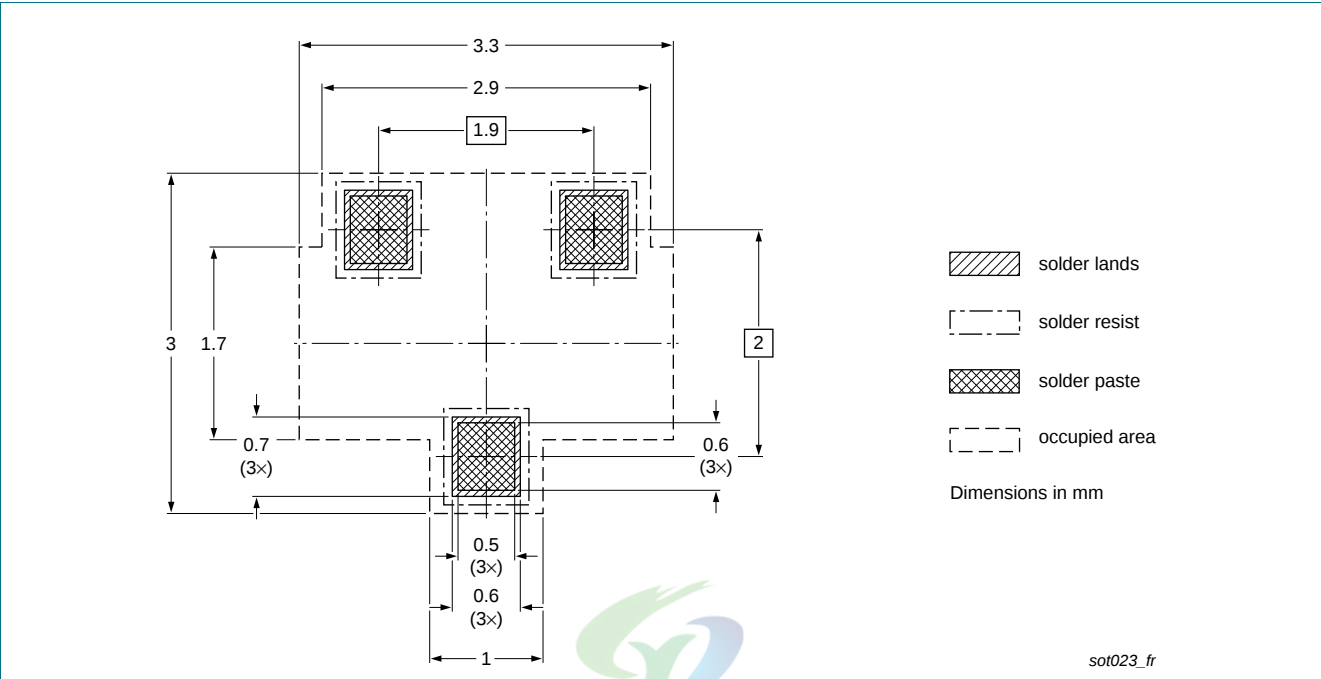


Fig 13. Package outline SOT23 (TO-236AB)

9. Soldering



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Product Portfolio

Primary Category	Secondary Category	Series	Model	Package	Link
Diode	Rectifier Diode	1N4007	1N4007	SMA(DO-214AC)	https://www.cnchipdepot.com/p/fosan-1n4007-107172.html
Diode	Rectifier Diode	1N4007	1N4007	SOD-123FL	https://www.cnchipdepot.com/p/fosan-1n4007-107173.html
Diode	Switching Diode	BAW56	BAW56	SOT-23	https://www.cnchipdepot.com/p/fosan-baw56-107174.html
Diode	Switching Diode	BAW56	BAW56W-6AF	SOT-323	https://www.cnchipdepot.com/p/fosan-baw56w-6af-107175.html

Diode	Switching Diode	1N4148	1N4148WT	SOD-323	https://www.cnchipdepot.com/p/fosan-1n4148wt-107176.html
Diode	Schottky Diode	1N5819	1N4148WS	SOD-323	https://www.cnchipdepot.com/p/fosan-1n4148ws-107177.html
Diode	Schottky Diode	SS34	SS34	SMA(DO-214AC)	https://www.cnchipdepot.com/p/fosan-ss34-107178.html
Diode	Schottky Diode	SS54	SS34B	SMA(DO-214AC)	https://www.cnchipdepot.com/p/baocheng-ss34b-12183.html
Diode	Schottky Diode	SS14	SS34C	SMA(DO-214AC)	https://www.cnchipdepot.com/p/baocheng-ss34c-12188.html
Diode Fast Recovery / High Efficiency Diode		US1M	US1M	SMA	https://www.cnchipdepot.com/p/fosan-us1m-107198.html
Diode Fast Recovery / High Efficiency Diode		US1M	US1MA-AAF	SMA	https://www.cnchipdepot.com/p/fosan-us1ma-aaf-107179.html
Diode Fast Recovery / High Efficiency Diode		US1M	US1MF	SMAF	https://www.cnchipdepot.com/p/baocheng-us1mf-17709.html
Diode	Switching Diode	BAV99	BAV99	SOT-23	https://www.cnchipdepot.com/p/agertech-bav99-18862.html
Diode	Switching Diode	BAV99	BAV99-6AF	SOT-23	https://www.cnchipdepot.com/p/fosan-ss34-107178.html
Diode	Switching Diode	BAV99	BAV99W-6AF	SOT-23	https://www.cnchipdepot.com/p/fosan-bav99w-6af-107181.html
Diode	Schottky Diode	B5819W	B5819WS	SOD-123	https://www.cnchipdepot.com/p/am-b5819ws-12167.html
Diode	Schottky Diode	B5819W	B5819W		https://www.cnchipdepot.com/p/am-b5819w-12166.html
Transistor (BJT)	NPN BJT	S8050	S8050	SOT-23	https://www.cnchipdepot.com/p/am-s8050-1108.html

Transistor (BJT)	NPN BJT	S8050	S8050-6AF	SOT-23	https://www.cnchipdepot.com/p/fosan-s8050-6af-107182.html
Transistor (BJT)	NPN BJT	SS8050	SS8050	SOT-23	https://www.cnchipdepot.com/p/alj-longjing-micro-s8050-1087.html
Transistor (BJT)	NPN BJT	SS8050	SS8050S	SOT-23	https://www.cnchipdepot.com/p/fosan-ss8050s-2326.html
Transistor (BJT)	NPN BJT	MMBT5551	MMBT5551	SOT-23	https://www.cnchipdepot.com/p/agertech-mmbt5551-1003.html
Transistor (BJT)	NPN BJT	MMBT5551	MMBT5551S	SOT-23	https://www.cnchipdepot.com/p/fosan-mmbt5551s-2327.html
Transistor (BJT)	NPN BJT	MMBT5551	MMBT5551-6AF	SOT-23	https://www.cnchipdepot.com/p/fosan-mmbt5551-6af-107183.html
Transistor	MOSFET	7002	2N7002	SOT-23	https://www.cnchipdepot.com/p/fosan-2n7002-107184.html
Transistor	MOSFET	7002	2N7002K	SOT-23	https://www.cnchipdepot.com/p/alj-longjing-micro--2n7002k-5083.html
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Transistor	MOSFET	7002	2N7002-6AF	SOT-23	https://www.cnchipdepot.com/p/fosan-2n7002-6af-107186.html
Transistor	MOSFET	BSS84	BSS84	SOT-23	https://www.cnchipdepot.com/p/fosan-bss84-107187.html
Transistor	MOSFET	BSS84	BSS84-6AF	SOT-363	https://www.cnchipdepot.com/p/fosan-bss84-6af-107188.html
Transistor (BJT)	NPN BJT	BC847	BC847A	SOT-23	https://www.cnchipdepot.com/p/alj-longjing-micro--bc847a-1052.html
Transistor (BJT)	NPN BJT	BC847	BC847B	SOT-23	https://www.cnchipdepot.com/p/alj-longjing-micro--bc847b-1056.html

Transistor (BJT)	NPN BJT	BC847	BC847C	SOT-23	https://www.cnchipdepot.com/p/alj-longjing-micro--bc847c-1055.html
Power IC	LDO	1117	LD1117-3.3	SOT223	https://www.cnchipdepot.com/p/hxy-mosfet-huaxuan-yang-electronics--ld1117-3-3-25490.html
Power IC	LDO	1117	LD1117-1.8	SOT223	https://www.cnchipdepot.com/p/hxy-mosfet-huaxuan-yang-electronics--ld1117-1-8-25429.html
Power IC	LDO	1117	LD1117-5.0	SOT223	https://www.cnchipdepot.com/p/hxy-mosfet-huaxuan-yang-electronics--ld1117-5-0-25444.html
Power IC	LDO	1117	LD1117-ADJ	SOT223	https://www.cnchipdepot.com/p/hxy-mosfet-huaxuan-yang-electronics--ld1117-adj-25427.html